

REMARKS

Claims 9, 12, 15, and 20 have been amended. Accordingly, claims 1-20 are pending in the present application. The claim amendments and new claims are supported by the specification and claims as originally filed, with no new matter being added. In particular, support for the amendments and new claims can be found in the new paragraph beginning at page at page 18, line 3, in the paragraph beginning at page 13, lines 19-21 and in Figure 6 of the application as filed. Accordingly, favorable reconsideration of the pending claims is respectfully requested.

1. Objection to the Drawings

The drawings have been objected to under 37 C.F.R. § 1.83(a). In particular, the Office Action indicates that the “continuously concave exterior surface extending from the base to the apex” of claim 9, the “exterior surface having a substantially paraboloid vertical profile that extends from the base to the apex” of claim 12, the “exterior surface having an ovoid profile that extends from the base to the apex” of claim 15, and the “emitter tip is generally conical and has a substantially rectilinear profile between said base and said apex” of claim 18 must be shown in the drawings or cancelled from the claims. Applicant respectfully traverses.

Counsel for Applicant, William J. Athay, conducted a telephonic conference regarding this matter with the Examiner on November 19, 2002. The following traversal of the objection to the drawings is presented in accordance with the agreement reached with the Examiner.

Applicant respectfully asserts that Figure 6 of the application, when read in view of the specification, shows the above-recited limitations. In particular, the specification states:

Figure 6 is an elevational cross-section view of an emitter tip according to an embodiment achieved by the inventive method, wherein it can be seen that the emitter tip has a substantially

paraboloid vertical profile that arcs in a concave fashion or of a section of a geometric oval fashion.

Specification at page 9, lines 3-7 (emphasis added). Further:

As lateral diffusion of etching gas through skirt region 108 occurs, the etching gas is substantially altered so as to be highly selective to oxide island 66 but the etching gas retains isotropic etching characteristics that continue to cause a substantially rectilinear etched profile of emitter tip 64. By such etching characteristics caused by mobilization of masking island 68 and its protection of oxide island 66 during the second etching stage, a substantially conical shape is achieved in emitter tip 64.

Specification at page 13, lines 14-19 (emphasis added). Also:

Figure 6 illustrates one achieved embodiment of the present invention according to the inventive method following completion of the third etching stage. For illustrative purposes, the vertical profile of emitter tip 64 is exaggerated to illustrate a deviation from absolute rectilinearity. In Figure 6 it can be seen that emitter tip 64 has an emitter tip profile 106 that has an arc length L and a chord length C. Emitter tip 64 has a height H and emitter tip profile 106 has a parabolic or oval sectional shape that subtends from the linearity of chord length C by a depth D. Emitter tip 64, formed by the method of the present invention, avoids the formation of wings 18 as illustrated in the prior art by having a substantially rectilinear profile. The example of Figure 6 is presented to illustrate an example of substantial rectilinearity under the invention when the vertical profile of emitter tip deviates from absolute rectilinearity.

Specification at page 15, lines 10-20 (emphasis added).

Accordingly, the prompt removal of the objection to the drawings under 37 C.F.R. § 1.83(a) is respectfully requested.

2. Objection to the Specification

The Abstract of the disclosure has been objected to because it contains more than 150 words.

In response, the Abstract has been amended to include fewer than 150 words. The prompt removal

of this rejection is therefore respectfully requested.

3. Rejections Under the Judicially Created Doctrine of Double Patenting

Claims 1-8 and 18-19 have been rejected under the judicially created doctrine of obviousness-type double patenting over claims 1-8 of U.S. Patent No. 6,175,184 B1 to Jones et al. for the reasons set forth on pages 2-3 of the Office Action.

This rejection will be addressed when the Examiner indicates the allowable subject matter.

4. Rejections Under 35 U.S.C. § 103(a)

Claims 9-18 and 20 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,663,608 to Jones, *et al.*, (hereinafter "*Jones*") for the reasons set forth on pages 3-4 of the Office Action. Applicant respectfully traverses.

Present independent claim 9 has been amended as follows and now recites, *inter alia*, "an emitter tip integral with an emitter layer disposed over said cathode conductive layer and having a base adjacent to the emitter layer, an apex, and a continuously concave exterior surface extending from the base to the apex. Present claim 12 has been amended as follows and now recites, *inter alia*, "an emitter tip projecting from and integral with an emitter layer disposed over said cathode conductive layer and having a base adjacent to the emitter layer, an apex, and an exterior surface, said exterior surface having a substantially paraboloid vertical profile that extends from the base to the apex." Present claim 15 has been amended as follows and now recites, *inter alia*: "an emitter tip that is an integral portion of a single emitter layer disposed over said cathode conductive layer and having a base adjacent to the emitter layer, an apex, and an exterior surface, said exterior surface having an ovoid profile that extends from the base to the apex." Finally, present claim 20 has been

amended as follows and now recites, *inter alia*, “an array of emitter tips formed as a part of an emitter layer disposed over said substrate, each of said emitter tips having a height and including a base adjacent to the emitter layer and an apex, each of said emitter tips having an exterior surface, said exterior surface having a profile with a continuous shape that extends from the base to the apex, said continuous shape being selected from the group consisting of a concave shape, a substantially paraboloid shape, and an ovoid shape.”

Applicant respectfully asserts that *Jones* does not teach or suggest such structures. As seen in Figures 40 of *Jones*, *Jones* discloses emitter tips that have a columnar, cylindrical main body portion (*see* column 9, lines 53-55) with a upper tip portion with a “generally convergent character and having in the embodiment shown concave side wall geometry” (*see* column 9, lines 56-59). *Jones* does not teach or suggest emitter tips having a base adjacent to an emitter layer and a continuous surface from the base to the apex as presently claimed.

Additionally, as part of the rejection of claims 9-18 and 20, the Examiner states that “it would have been obvious to one of ordinary skill in the art to provide a concave/substantially paraboloid/ovoid/rectilinear emitter shape,” and in support thereof refers to: (1) a single passage in the background in the application; and (2) *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). Applicant respectfully disagrees with the Examiner’s application of both. First, with regard to the passage in the background of the present application, the Applicant notes that the entire specification must be read in context and as a whole. Thus, while Applicant acknowledges that: “a variety of shapes have been used for emitter tip 14, so long as the emitter tip tapers to a relatively fine point,” (specification at page 3, lines 17-18) the Applicant denies that this cedes that the present claims cannot be patentable. Rather, Applicant is merely acknowledging that other shapes have been used

in the past. Such an admission does not cede that all *inventive changes* in the shape of an emitter tip are nevertheless obvious.

In fact, other sections of the application very clearly point out that not all shapes, although possibly functional, are equally effective or desirable. For example, the application states: "Emitter tips that have pronounced curvilinear vertical profiles have been found to provide sub-grade performance compared to those that are more nearly rectilinear." Specification at page 4, lines 16-18.

With regard to *In re Dailey*, *In re Dailey* states: "Appellants have presented no argument which convinces us that that the particular configuration of their container is significant or is anything more than one of numerous configurations a person of ordinary skill in the art would find obvious." *In re Dailey*, 149 U.S.P.Q. 47, 50. *In re Dailey* therefore simply stands for the non-controversial proposition that an obvious shape change does not impart patentability to a device. In contrast, in the present case the presently recited emitter tips are not mere reconfigurations of known emitter tips. Rather, the presently recited emitter tips result from novel methods and comprise advantageous tip designs not previously taught or suggested by the prior art. Therefore, Applicant respectfully asserts that *In re Dailey* is inapplicable to the present case.

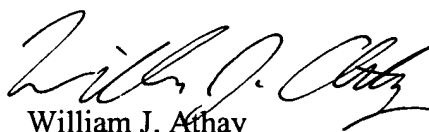
Claims 10, 11, 13, 14, and 16-18 depend from a respective one of claims 9, 12 and 15 and are patentable for at least the reasons presented hereinabove with respect to those claims. Accordingly, claims 9-18 and 20 would not have been obvious over the cited references and Applicant therefore respectfully requests that the rejection of these claims under 35 U.S.C. § 103(a) be withdrawn.

CONCLUSION

In view of the foregoing, Applicant respectfully requests favorable reconsideration and allowance of the present claims. In the event the Examiner finds any remaining impediment to the prompt allowance of this application which could be clarified by a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney.

Dated this 29th day of November 2002.

Respectfully submitted,



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PATENT TRADEMARK OFFICE

VERSION WITH MARKINGS TO SHOW THE CHANGES MADE

In the Specification:

Please amend the paragraph beginning at page 2, line 2 of the application as filed as follows:

This is a continuation of U.S. Patent Application Serial No. 09/022,763, filed on February 12, 1998, now U.S. Patent No. 6,175,184, entitled BUFFERED RESIST PROFILE ETCH OF A FIELD EMISSION DEVICE STRUCTURE, from which divisional U.S. Patent Application Serial No. 09/404,913, now U.S. Patent No. 6,190,930 was filed on September 24, 1999, both of which are herein incorporated by reference in their entirety.

Please amend the Abstract of the Invention at page 28, lines 2-14 as follows:

A field emission device comprises an emitter tip that is optionally formed from and integral with an emitter layer. The emitter tip has a base, an apex, and an exterior surface having a profile between the base and the apex. The profile has a continuous shape that extends from the base to the apex. The devices may be part of a flat panel display device that also includes a substrate, a cathode conductive layer disposed over the substrate, an array of emitter tips each formed from an emitter layer disposed over the substrate, a conductive gate structure disposed over the cathode conductive layer, an array of apertures formed through the conductive gate structure, and an anode panel for emitting light in response to electrons emitted from the array of emitter tips.

[A method for forming an emitter tip for use in a field emission device. An emitter layer is provided over a substrate. The emitter layer is overlaid with a blanket dielectric which is in turn overlaid by a masking layer. In a first etching operation, a masking island and an underlying dielectric island are formed from the masking layer and the blanket dielectric, respectively. These islands serve as a masking structure during subsequent etching processes by which an emitter tip is formed from the emitter layer. Accordingly, a second etching operation is conducted, whereby an etch chemistry which exhibits both isotropic and anisotropic characteristics is used to remove a portion of the emitter layer by undercutting beneath the masking structure. A third etching operation is conducted, wherein the etch chemistry is substantially more anisotropic than the etch chemistry of the second etching operation. The second and third etches mobilize a portion of the masking layer and form an emitter tip from the emitter layer. The emitter tip has a substantially rectilinear vertical profile.]

In the Claims:

Claims 9, 12, 15, and 20 have been amended as follows:

9. (Once Amended) A field emission device comprising:
 - a substrate;
 - a cathode conductive layer disposed over said substrate; and
 - an emitter tip integral with an emitter layer disposed over said cathode conductive layer and having a base adjacent to the emitter layer, an apex, and a continuously concave exterior surface extending from the base to the apex.
12. (Once Amended) A field emission device comprising:
 - a substrate;
 - a cathode conductive layer disposed over said substrate; and
 - an emitter tip projecting from and integral with an emitter layer disposed over said cathode conductive layer and having a base adjacent to the emitter layer, an apex, and an exterior surface, said exterior surface having a substantially paraboloid vertical profile that extends from the base to the apex.
15. (Once Amended) A field emission device comprising:
 - a substrate;
 - a cathode conductive layer disposed over said substrate; and
 - an emitter tip that is an integral portion of a single emitter layer disposed over said cathode conductive layer and having a base adjacent to the emitter layer, an apex, and an exterior surface, said exterior surface having an ovoid profile that extends from the base to the apex.
20. (Once Amended) A flat panel display device comprising:
 - a substrate;
 - a cathode conductive layer disposed over said substrate;
 - an array of emitter tips formed as a part of an emitter layer disposed over said substrate, each of said emitter tips having a height and including a base adjacent to the emitter layer and an apex, each of said emitter tips having an exterior surface, said exterior surface having a profile with a continuous shape that extends from the base to the apex, said continuous shape being selected from the group consisting of a concave shape, a substantially paraboloid shape, and an ovoid shape;
 - a conductive gate structure disposed over said cathode conductive layer;
 - an array of apertures formed through said conductive gate structure, each of said emitter tips being exposed through one of said apertures; and
 - an anode panel for emitting light in response to electrons emitted from said array of emitter tips.